



# A Smarter Way to Inspect

The shift toward connected and predictive maintenance.

**PG: 24**

## Expert Interview

What It Takes to Build Reliable Systems in Hydrogen, Offshore, and EPC - With Urvesh Vala



# A Heartful Thank's to all the Contributors

**Business &  
Communications**  
*Editor in Chief*  
Santosh Gavankar

*Business Head*  
Pranjal Mahajan

**Marketing**  
*Marketing Director*  
Ravindra Warang

*Marketing Head/Editor*  
Kadambari Bendre

*Marketing Specialist*  
Prathmesh Kamat  
Himanshu Mishra  
Rushil Gupta

**Copy**  
*Copy Writing*  
Abhishek Sawant

**Design**  
*Design Lead*  
Bhavesht Sawnat

*Graphics*  
Komal Vishe  
Shruti Shethia

**Technical Content**  
Abhishek Chaurasia

**Special Thanks to our Contributors**

Chandan Mukhopadhyay  
Urvesh Vala  
Abyss Solutions  
Ultracoustics Technologies Ltd.  
Ravikant Mordia  
Arvind Kumar Verma



12GRIDS<sup>✓</sup>

WE ARE THE ONE  
YOU ARE

LOOKING FOR

A 360° CUSTOMER EXPERIENCE—LED  
MARKETING AGENCY



SCAN TO KNOW MORE



## Editorial

### *The Shift has Started*

Over the last few years, the conversations around inspection and asset integrity have started to feel very different. Earlier, the focus was mostly on finding defects, following procedures, and keeping systems operational. But today, the industry seems to be moving toward something much bigger, understanding how assets behave over time, predicting failures before they happen, and making faster, smarter decisions using technology and data.

As we worked on this edition, that shift kept appearing across every discussion in one way or another. Whether it's pipelines, offshore infrastructure, rail networks, hydrogen systems, or advanced manufacturing environments, the challenges are becoming more complex, and so are the expectations from inspection and engineering teams.

What makes this transformation interesting is that it's happening from every direction at once, through research, field experience, startup innovation, and large-scale industrial projects. The lines between engineering, inspection, software, and intelligent monitoring are gradually starting to merge.

This edition is a small reflection of that larger transition happening across the global NDT and asset integrity ecosystem, where the industry is steadily moving from reactive practices toward more connected, data-driven, and future-ready approaches.

A big thank you to all our contributors, industry experts, researchers, and readers for continuing to be part of these conversations with us.

We hope you enjoy the May 2026 edition of OnestopNDT.

Santosh Gavankar  
Editor-in-chief



10

Top Stories

Waygate Technologies Expands Remote Visual Inspection Capabilities with Next-Generation...  
Waygate Technologies, a business of Baker...

18

Expert Article

A Comprehensive Overview of Pipeline Integrity Management and Inspection Practices  
Pipelines are a crucial component in the oil and...

24

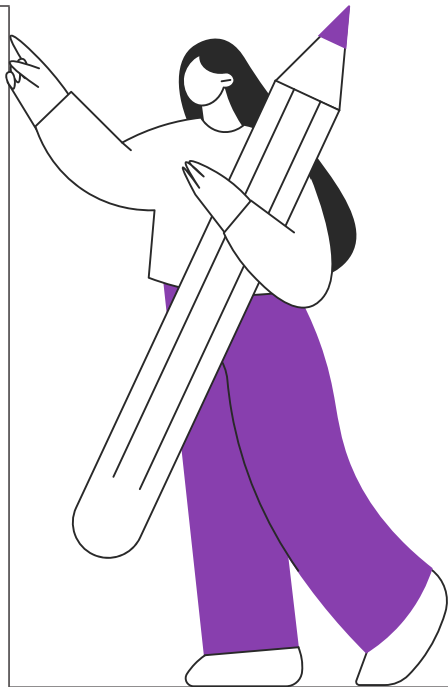
Expert Interview

What It Takes to Build Reliable Systems in Hydrogen, Offshore, and EPC - With Urvesh Vala  
With extensive experience across global EPC organizations such as INOXCVA, Bechtel, Technip...

32

Startup to Watch

Beyond the Contact Barrier: How Ultracoustics is Bringing MHz-Range Ultrasonics...  
If you work in ultrasonic testing, you know the routine. Apply couplant. Make contact. Take a...



36

Case Study

Application of AI and Digital Twin Technology for Large-Scale Offshore Inspection and Mainten...  
In 2026, the global asset integrity and Non-De-

42

Research Paper

Nondestructive testing methods for rail defects detect...  
The rapid progress in the construction of heavy-haul and high-speed railways has led to a surge...

# SOME THINGS IN NDT CAN'T BE ~~Googled.~~

That's why we created **NDT Talks** — a monthly panel where real experts share insights you won't find online.





Top Stories

# *Insights in Focus*

*Top Stories Shaping  
the NDT Industry*





# Waygate Technologies Expands Remote Visual Inspection Capabilities with Next-Generation Mentor Flex+



Image Source - @Waygate Technologies

**W**aygate Technologies, a business of Baker Hughes and a global provider of non-destructive testing (NDT) solutions, has announced the expansion of its VideoProbe™ portfolio with the launch of the next-generation Everest Mentor Flex+ video borescope. The system is designed to enhance remote visual inspection (RVI) capabilities in the mid-market segment, particularly for demanding industries such as aerospace and energy.

Building on the established performance of its predecessor, the Mentor Flex+ introduces interchangeable probe technology and advanced 3D measurement capabilities, enabling more flexible and comprehensive asset inspections in complex industrial environments.

“As industrial inspection environments evolve, our customers need versatile equipment that adapts to various tasks efficiently,” said Michael Domke, General Manager Visual at Waygate Technologies. “With the latest release of Mentor Flex+, we are delivering a practical solution. The addition of QuickChange probes empowers technicians to address many inspection needs with a single handset. This improves overall efficiency and helps reduce the cost of ownership.”

## Adaptability for Complex Inspection Requirements

The Mentor Flex+ is equipped with QuickChange interchangeable probes available in 4.0 mm and 6.1 mm diameters, along with a 6.2 mm working channel probe for

foreign object retrieval. A compact camera head option on the 6.1 mm probe allows technicians to navigate tight spaces more effectively while reducing the risk of mechanical wear during routine inspections.

**Advanced Measurement and Imaging Capabilities**  
The system incorporates Real3D™ measurement technology, bringing advanced 3D point cloud capabilities to the mid-range market. This enables inspectors to capture not only images but also quantifiable data such as depth, surface profiles, and defect dimensions with sub-millimeter accuracy.

High-resolution imaging is displayed on a WXGA LCD touchscreen, enhancing flaw visibility, while Automatic Adaptive Noise Reduction (ANR) improves image clarity by minimizing visual interference. Additional features such as the Always-Up gravity sensor and Auto-Rotate mode support spatial orientation and ease of navigation during inspections.

## Streamlined Data Management and Connectivity

The Mentor Flex+ integrates with Waygate’s InspectionWorks platform, a cloud-based inspection solution designed to manage and analyze NDT data. Enhanced wireless connectivity and Menu Directed Inspection (MDI) functionality guide operators through standardized workflows while automatically tagging inspection data.

The Push2IW feature enables seamless transfer of inspection data to the cloud, supporting secure storage and structured reporting, thereby reducing administrative workload and accelerating decision-making processes.

## Engineered for Harsh Industrial Conditions

Designed for use in challenging environments, the system can operate at temperatures of up to 100°C (212°F), allowing inspections to be conducted without waiting for equipment cooldown. The device is housed in a rugged, military-grade aluminum casing with Gorilla® Glass and meets MIL-STD-810H standards, ensuring durability and reliability across varied operating conditions.

The launch of the Mentor Flex+ reflects Waygate Technologies’ continued focus on advancing NDT inspection capabilities through innovation in remote visual inspection technologies. The system is now available globally, as aerospace and defence, automotive, construction, manufacturing, and mining. The acquisition of Waygate Technologies expands its capabilities in nondestructive evaluation and industrial inspection technologies.

The transaction is subject to regulatory approvals and other customary conditions, and is expected to close in the second half of 2026.





# Ionix Advanced Technologies Receives King's Award for Innovation in Extreme-Environment Ultrasonic Sensing



Image Source - @Ionix

**I**onix Advanced Technologies Ltd has been awarded His Majesty The King's Award for Enterprise: Innovation 2026 for its development of the HotSense sensor platform and proprietary HPZ piezoelectric materials designed for extreme-environment sensing, monitoring and measurement applications.

The award, regarded as the United Kingdom's highest official business accolade, recognises Ionix's contribution to continuous, real-time ultrasonic sensing technologies capable of operating in environments ranging from -200°C to +600°C, including high-pressure, explosive and radioactive conditions where conventional sensor technologies are unable to perform reliably.

The company's HotSense platform has been developed to support continuous in-service monitoring without requiring plant shutdowns, scaffolding access or temporary instrumentation. The sensing technology is designed for deployment through fixed-point installations, manual inspections and remotely operated or robotic platforms.

According to the company, the system enables real-time process control and structural health monitoring across industrial environments, supporting operational efficiency, process optimisation, reduced unplanned outages and extended asset life.

At the core of the platform is Ionix's patented HPZ piezoelectric ceramic material, engineered to maintain electro-mechanical performance under extreme operating

conditions. The material powers a range of ultrasonic sensing applications including corrosion monitoring, crack detection, gas flow metering and level sensing in harsh industrial environments.

Piezoelectric materials are widely used in applications such as medical ultrasound, naval SONAR systems and automotive parking sensors. Ionix stated that its HPZ technology has also been adopted by major industrial measurement and control providers requiring high-performance piezoelectric components for specialist applications.

In addition to the HotSense platform, Ionix has recently introduced TRND, an intelligent corrosion and erosion monitoring system designed as a turnkey monitoring solution. The company has also expanded its materials portfolio with the development of XLF lead-free piezoelectric materials aimed at supporting OEM adoption in markets with tightening regulations on lead-based materials.

The company said the technologies collectively address industrial monitoring, sensing and measurement requirements across sectors including oil and gas, power generation and industrial process industries.

Ionix noted that the King's Award recognition marks a major milestone for the company since its formation as a University of Leeds spin-out in 2011. The company recently inaugurated a centre of excellence for extreme-environment sensing and is continuing to expand its advanced materials manufacturing operations in Leeds.

During a recent visit, Rachel Reeves remarked, "businesses like Ionix showcase the great potential that Britain has to lead in sectors such as advanced manufacturing".

The company also highlighted growing global demand for structural health monitoring and corrosion management technologies, driven by ageing infrastructure, stricter regulations and increasing costs associated with unplanned industrial outages.

Ionix stated that the HotSense platform addresses a key gap in the market by enabling continuous and quantitative wall-thickness monitoring in highly demanding process environments. The company currently has active engagements across the United Kingdom, continental Europe, North America and the Middle East, with future integration opportunities in small modular reactors, hydrogen infrastructure and next-generation battery storage technologies.





# BMW Group Plant Leipzig Introduces Terahertz-Based NDT for Plastic Components



Sources - @BMW

**B**MW Group has introduced a terahertz-based measurement system at its Leipzig plant, marking a significant advancement in non-destructive testing (NDT) within automotive production. The new technology enables automated, precise and reproducible inspection of paint layer thickness on plastic exterior components directly in series production.

As part of its broader push toward digitalisation, the Leipzig facility has scaled the system to operate inline, allowing

quality inspections to be conducted without interrupting the manufacturing process. The implementation reflects a shift toward real-time, data-driven quality assurance in industrial environments.

“Terahertz measurement technology replaces complex manual inspection with a fully automated solution, taking quality assurance to an entirely new level,” says Christoph Theiselmann, Head of Exterior Plastics, Production at Plant Leipzig.

At the core of the deployment is the “Irys” terahertz measurement system, developed by das-Nano. Designed specifically for industrial inline inspections, the system performs contactless and non-destructive measurement of multi-layer paint systems while delivering real-time data.

## Transition from Destructive Testing to Inline NDT

Previously, paint layer thickness inspections at the Leipzig plant relied on manual methods involving scalpels and microscopy, resulting in the destruction of tested components and delayed detection of deviations. The introduction of terahertz-based NDT eliminates these limitations.

Sensors mounted on robotic systems within the end-of-line measurement cell automatically position themselves relative to each component. By analysing the time-of-flight of reflected terahertz waves, the system measures individual paint layer thicknesses within seconds, achieving micrometre-level accuracy.

This transition not only removes the need for destructive testing but also enhances process efficiency, reduces material waste and supports cost-effective operations. The ability to detect deviations early strengthens process control and improves overall product quality.

“The combination of higher measurement accuracy, direct process integration and full digitalisation delivers tangible benefits across the entire production chain, strengthening quality, economic efficiency and resource conservation in equal measure,” Christoph Theiselmann adds.

## Advancing Digital Paint Shop Operations

The integration of terahertz measurement technology follows the plant’s earlier implementation of automated surface inspection in 2024, representing another step toward a fully digital paint shop for plastic components. The system generates fully digital measurement and quality data, enabling advanced analysis and future integration with AI-based tools for trend evaluation and process optimisation.

## Setting New Benchmarks in Automotive NDT

By industrialising terahertz-based inspection, the Leipzig facility has become the first within the BMW Group to deploy this technology in in-house production. It also establishes a

benchmark in the plastics segment, being the first to apply terahertz technology for inspecting paint layer thickness on plastic components.

Following successful piloting and ramp-up, the system is now compatible with all component carrier systems and is being extended to support all colour variants. The technology also presents opportunities for broader implementation across other production facilities and supplier networks.

The Exterior Plastics team at Leipzig, comprising 450 employees, continues to support multiple BMW Group plants, including Dingolfing and Regensburg, by manufacturing injection-moulded components such as bumpers, side sills and spoilers, further reinforcing the role of advanced NDT in modern automotive manufacturing.



# FARO CREAFORM's HandySCAN 3D EVO Series Wins Red Dot Award for Product Design



Image Source - @creaform3d

**F**ARO CREAFORM, a business of AMETEK, Inc. and global provider of 3D scanning and portable CMM solutions, today announced that the company's HandySCAN 3D EVO Series™ handheld 3D scanner has won the distinguished Red Dot Award for Product Design.

Known for over 70 years as the benchmark for global product design excellence, Red Dot has become one of the most sought-after seals of quality and international prestige. Each year thousands of companies submit applications in categories ranging from Product Design, Brands & Communication, and Design Concept. And this year FARO CREAFORM is a Product Design standout winner, our 6th such award in this category for the HandySCAN 3D lineup. This recognition reinforces the fact that innovation and design are in our DNA, driving our mission to deliver an exceptional 3D scanning experience through our industry-leading handheld 3D scanners.

"We at FARO CREAFORM are honored that our market-leading handheld 3D scanner has been recognized by this year's Red Dot Award Jury," said Fanny Truchon, FARO

CREAFORM President & Chief Executive Officer. "This highly sought-after recognition celebrates a design philosophy that successfully unifies unmatched usability, high-end performance, and distinctive FARO CREAFORM styling—while remaining purpose-built for industrial environments. Products like the HandySCAN 3D EVO Series exemplify our commitment to advancing 3D metrology solutions that deliver formidable accuracy and precision, while remaining intuitive across a wide range of shop-floor applications."

The HandySCAN 3D EVO Series comes in a compact, lightweight design featuring a large 4.3-inch touchscreen display that enables real-time visualization and enhanced freedom of movement and efficiency.

Through its ergonomic graphical user interface (GUI), the EVO Series enhances the user experience by streamlining the inspection process and eliminating the need to move back and forth between the part and the laptop. Additionally, its optimized architecture offers three mechanical buttons to navigate on-screen menus, and includes a directional distance indicator. The device connects through a single rugged industrial push-pull secure connector, balanced for optimal weight distribution.

"The novelty of its appearance, with its large touchscreen, its sleek heatsink protector grid, its discreet side bumpers and its trapezoid camera covers, offers a unique visual impact," added Marco St-Pierre, DVP Innovation 3D Scanners. "Subtle but significant finishing touches, like the textured handle and soft touch mat black paint, that offer anti slip features, ensure enduring aesthetics."

Each year, the Red Dot Jury is comprised of 40 international experts who test, discuss and evaluate each entry live and on site. Entrants are judged on several criteria, including degree of innovation, functionality, formal quality and ergonomics.



Order now &  
**SAVE £200\***

DISCOUNT CODE **NT26**



# Skip the cooldown.

## High Temperature EX Probe & Cygnus 1 EX Gauge, Certified for Zone 0 Hazardous Areas.

Engineered to be used with the Cygnus 1 Ex ultrasonic thickness gauge, the High-Temperature Ex Probe can measure hot surfaces continuously without cooling period, reducing inspection time & facilitating more effective measurement.



**Cygnus 1 EX**

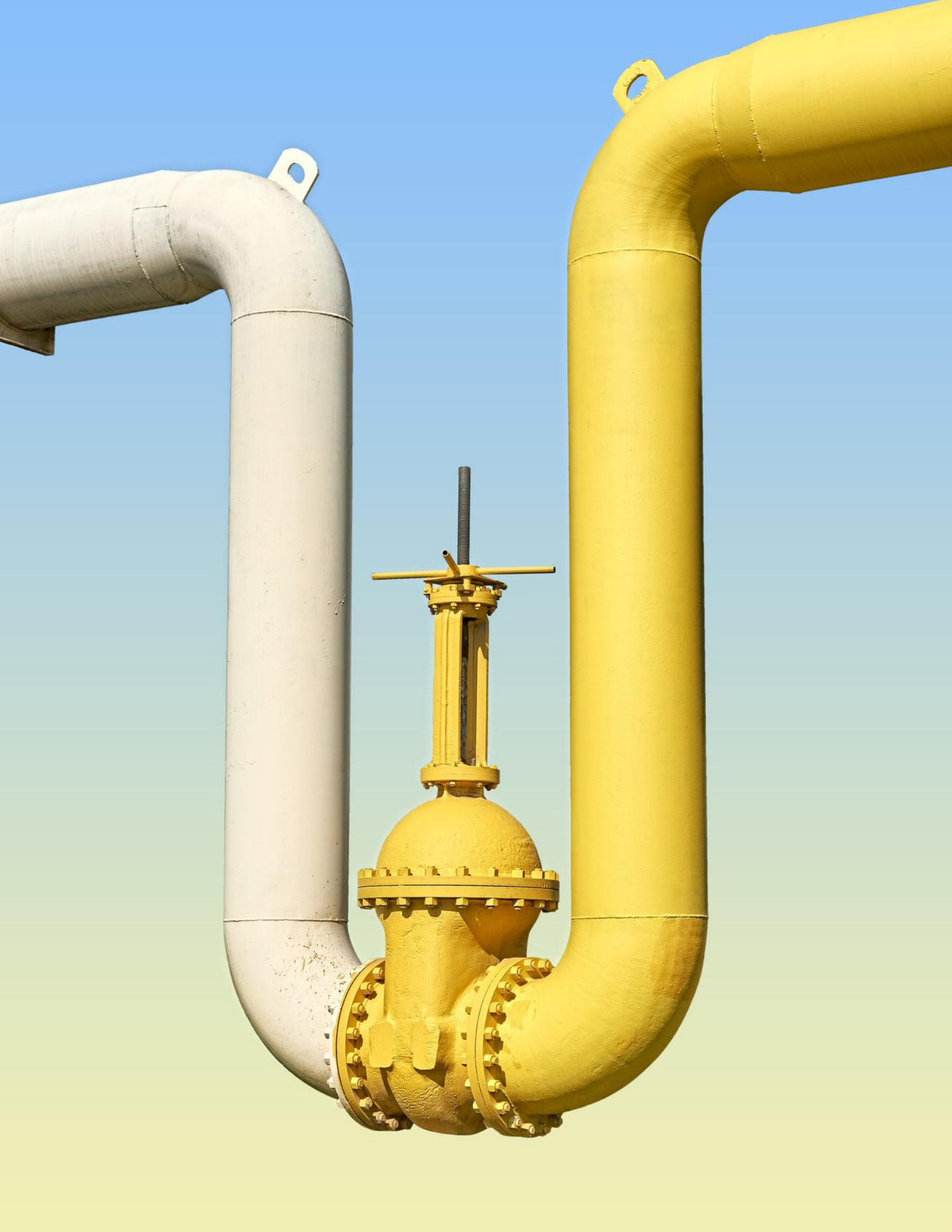
**Cygnus HTP EX**

Discover more: [cygnus-instruments.com](https://cygnus-instruments.com)

\*Offer only valid when ordering directly from Cygnus Instruments Ltd







## Expert Article

# A Comprehensive Overview of Pipeline Integrity Management and Inspection Practices

## ■ Introduction

Pipelines are a crucial component in the oil and gas sector. With 57.5% of global primary energy use from oil and natural gas, these two sources are the most commonly used (Dudley, 2019). However, flammable and explosive materials in pipelines can cause accidents, such as fires, explosions, and the release of toxic gases (Chen et al., 2020). Pipelines are also vulnerable to damage from natural disasters like lightning, earthquakes, and floods. Pipeline failures lead to financial losses, environmental damage, and safety risks. Ensuring pipeline integrity and safety is essential for reliable operation, environmental protection, and economic efficiency.



**Chandan Mukhopadhyay**  
Former Senior Scientist IGCAR

## ■ Onshore Pipelines

Oil and gas are transported via onshore pipelines, which are made of carbon steel and buried underground or erected above ground on land. These pipelines are subject to a variety of environments, including plains, mountains, and deserts, as well as different soil types and weather patterns.

## ■ Offshore Pipelines

Strong water currents and the marine atmosphere affect offshore pipes used for subsea transportation and the delivery of carbon products. These pipelines are difficult to construct and can get damaged by water pressure, corrosion, erosion, fishing nets, and boat anchors. Sand and other abrasive materials create erosion, while acidic substances and temperature changes induce corrosion. Ocean temperature fluctuations and strong water currents put strain on offshore pipes and can lead to wear.

## ■ Integrity & Safety of Pipelines

Evaluating and preserving the safety and condition of pipelines is known as integrity management of pipelines. It encompasses, in general, (a) appropriate design, construction, operation, and maintenance; (b) identifying any adverse behavior that could jeopardize integrity and safety; and (c) risk mitigation by eliminating or minimizing pipeline damage.

There are several obstacles to pipeline integrity and safety, including:

- Pipeline aging that increases the risk of catastrophic failures
- Weather and soil movement which can erode structural integrity
- Human error during operation and maintenance and this can lead to catastrophes
- Material problems such as erosion and corrosion causing leaks and failures



■ Pipeline Integrity Management

Assessment

Pipeline assessment involves thoroughly examining the internal and external parts of pipelines, calculating their geometry, modeling fluid flow, determining corrosion rates, and assessing risk. Detecting any damage or defects on the inside and outside of the pipelines helps evaluate their condition and develop necessary repair plans.

There are various benefits to performing pipeline integrity assessments:

5.1.1 Safety and reliability

To take proactive steps to stop damage, leaks, accidents, or malfunctions, regular assessment of pipelines is helpful. Early identification of damage or flaws enables prompt repair and ensures continuous operations, enhancing safety and reliability.

5.1.2 Reduced expenses and downtime

Downtime and emergency repairs are minimized and this reduces expenses.

5.1.3 Compliance with regulations

Adherence to regulatory compliance is crucial, and a thorough evaluation of pipeline integrity may make this possible.

5.1.4 Preservation of the environment

A thorough evaluation of integrity could reduce any environmental damage.

5.1.5 Extension of life

Assessment, routine maintenance, and testing of pipelines contribute to the extension of pipeline life.

Planning for Integrity

This entails establishing standards for maintenance and inspection in order to stop material deterioration and damage to pipeline integrity from outside sources.

Managing Projects

Among the several tasks involved in pipeline integrity management are material condition assessment, data accuracy verification, operational readiness assurance, burst resistance testing, and third-party verification.

■ Components of Pipeline Integrity Management

The following are important elements of pipeline integrity management:

- Examining the pipeline
- Data collection and analysis

- Strategies for maintenance and repairs
- Adherence to regulations
- Maintaining records

■ Pipeline Integrity Testing

Difficulties

7.1.1 Length of pipelines

Most pipelines are long-distance, which makes them difficult to inspect and maintain, and frequently calls for sophisticated tools and techniques.

7.1.2 Adverse operational circumstances

It is difficult to examine and maintain pipes in the gas and petroleum industries because they carry toxic, combustible, or high-pressure media that must be handled with extreme caution. For instance, handling significant amounts of water during hydrostatic testing necessitates careful attention, whereas pneumatic testing is extremely dangerous due to the energy stored in compressed gases.

7.1.3 Complex data interpretation

In the oil and gas industries, a large number of sensors are used to collect data from lengthy pipelines. This produces an enormous amount of data that needs to be processed, requiring specialist knowledge and the most recent tools.

Integrity Testing Methods

7.1.1 Hydrostatic testing

For pipeline integrity and leak-tightness testing, hydrostatic testing is frequently utilized. This involves holding pipelines at a pressure higher than their operating pressure for a certain amount of time. Pressure drops, leaks, or structural problems are used to ensure the integrity.

7.2.2 Pneumatic testing

In pneumatic testing, pipelines are pressurized using nitrogen, compressed air, or other inert gases. Because any structural or equipment failure during pneumatic testing releases a lot more stored energy than in water strict safety procedures are followed when testing pipelines during pneumatic testing as opposed to hydrotesting.

7.2.3 Non-destructive testing

In the oil and gas industries, a large number of sensors are used to collect data from lengthy pipelines. This produces an enormous amount of data that needs to be processed, requiring specialist knowledge and the most recent tools.

• (a) Magnetic flux leakage (MFL)

Applying a magnetic field to a portion of the pipe causes iron particles to move across its surface, a phenomenon known as



magnetic flux leakage. Cracks or discontinuities are revealed when these particles collect at surface or near-surface flaws. This method is employed to identify corrosion and changes in the pipeline's wall thickness.

• (b) Ultrasonic testing (UT)

High-frequency sound waves are employed to assess the thickness of pipe walls and find corrosion and fissures. UT needs qualified laborers and specialized equipment.

• (c) Acoustic

Leakage causes pressure changes in pipelines, which produce sound waves. This can be detected by employing acoustic sensors.

• (d) Fiber optic

Fiber-optic sensors can detect changes in temperature, strain, and vibration patterns in pipelines, and the resulting data are highly valuable for pipeline integrity monitoring.

• (e) Radiographic testing (RT)

Porosity, inclusions, fissures, and other flaws in welds can be found using the image produced by RT, which is based on X-rays or gamma rays. Welds are tested using RT both during manufacture and after pipeline repairs.

(f) Smart pigging or intelligent pigging

Inspection gauges, sometimes referred to as "pigs," that are fitted with MFL or ultrasonic sensors are used in smart pigging, also known as intelligent pigging. The inside conditions of pipelines can be regularly monitored by pigs placed into them. For long-distance pipelines, smart pigging is particularly helpful in detecting pitting, metal loss, cracking, weld flaws, and other problems.

■ Maintenance towards Pipeline Integrity

Difficulties

- With ageing, chances of corrosion and crack damage increase
- Difficulty in maintaining pipelines in isolated areas and challenging terrain
- Robust solutions are needed to analyze a huge amount of inspection and maintenance data
- Adhering to intricate and dynamic safety and environmental regulations can be difficult



Important Maintenance Strategies

- Frequent examinations of pipes employing different methods
- Controlling pipeline material corrosion
- Using systems for leak detection
- Pigging activities are used to clear buildup and clean pipelines
- Upkeep of routines

Important Maintenance Strategies

- Consistent monitoring for leaks and defects
- Establishing a mechanism for risk-based evaluation
- Preventing corrosion
- Early warning of third-party damage
- Cutting-edge health monitoring technology
- Creating a precise operational procedure
- Integration and analysis of data
- Constant training
- Keeping up with regulations
- Being ready for emergencies



Technological Progress

Sensors for Pipeline Monitoring

Real-time data on temperature, pressure, flow rates, and other variables is provided by advanced sensors, and this data can be used to improve pipeline damage and flaw detection.

Analytics for Prediction

Proactive maintenance is made possible by the application of machine learning algorithms to anticipate possible faults.

Robotics

Robotic devices known as “crawlers” and drones can be used to navigate pipelines to do minor repairs and inspections. Robotic devices equipped with cameras and sensors are highly helpful for doing in-depth analyses in difficult-to-reach areas and inspecting the interior of pipelines.

Analysis of Multiple Gases

Multi-gas analysis is an additional method for measuring and identifying different gases in a pipeline. Such gases include carbon dioxide, hydrogen sulfide, and methane.

Things of Internet (IoT)

A revolutionary tool for pipeline integrity systems is the integration of real-time monitoring systems with sensors and Internet of Things (IoT) devices. It is possible to do pipeline health evaluation using data intelligence, which enables operators to promptly spot anomalies while gathering data on a variety of variables, such as material damage and temperature, pressure, and flow rate.

Artificial Intelligence (AI) in Pipeline Integrity

AI has made it possible to comprehend the reasons behind failures and take prompt action to maintain pipeline integrity.

Predictive Maintenance

AI is used to find patterns that indicate wear, erosion, corrosion, or leak. High-speed analysis of complex datasets allows for repair decisions to be made well before the damage becomes catastrophic. Pipeline conditions are continuously assessed to minimize downtime, eliminate unexpected failures, and increase cost effectiveness.

Leak Detection

In contrast to traditional manual and slow detection approaches, AI-assisted leak detection enable the analysis of massive data sets and assist in identifying anomalies in pressure, flow rate, and auditory signatures that suggest a potential leak. The accuracy of leak detection is also increased by the AI-enhanced acoustic approach.

Corrosion Monitoring

Pipeline corrosion detection can be aided by the integration and analysis of data from different NDT sensors, such as magnetic flux, ultrasonic, and fiber optic, utilizing AI techniques to identify changes in composition and thickness.

Automated Inspection

By taking high-resolution pictures to find defects, AI-enabled drones, robotic crawlers, and satellite photos are very helpful for automated pipeline inspections.

Satellite and Aerial Surveillance

High-resolution photography and satellite-based synthetic aperture radar (SAR) make it possible to identify pipeline anomalies, vegetation disturbances, and any unapproved



excavation operations endangering the pipeline’s structural integrity.

Advances in NDT sensors and AI

AI-integrated materials and embedded sensors are used in the creation of self-healing pipelines so that self-repair operations can start when minor damage is detected. These materials are nanoparticles and smart polymers. Blockchain technology and AI can produce tamper-proof recordings of sensor readings and data during maintenance. Self-optimizing pipelines that can function independently are becoming possible thanks to the developments in IoT, AI, and remote control.

References

Dudley, B., 2019. B.P., Statistical Review of World Energy 2019. World Petroleum Congress, London.

Chen, C., Reniers, G., Khakzad, N., 2020. Cost-benefit management of intentional domino effects in chemical industrial areas. Process Saf. Environ. Protect. 134, 392-405. <https://doi.org/10.1016/j.psep.2019.10.007>.



Expert Interview

# What It Takes to Build Reliable Systems in Hydrogen, Offshore, and EPC?

W

ith extensive experience across global EPC organizations such as INOXCVA, Bechtel, Technip Energies, and Larsen & Toubro, Mr. Urvesh Vala currently leads Materials Engineering and Technology across domains including Green Hydrogen, Offshore, Cryogenics, Refinery, Corrosion, Integrity, and Decarbonization. In this conversation with OnestopNDT, he shares insights into the evolving role of materials engineering, advanced NDT, and digital integrity in enabling reliable and future-ready industrial infrastructure.

**Q:** Mr. Urvesh, welcome to OnestopNDT — it's a pleasure to have you with us. You currently lead Materials Engineering Technology at Larsen & Toubro with mandates spanning Green Hydrogen, Offshore, Cryogenics, Refinery, Corrosion, Integrity



**Urvesh Vala**  
Head of Material Engineering Technology  
Larsen & Toubro

**& Decarbonization. Could you begin by walking us through your professional journey and how these diverse technology domains converged into your current leadership role?**

**A:** Thank you for inviting me. It's great to be here. When we talk about materials engineering today, we are no longer talking about selecting metals from a datasheet, Material Selection Report, or Material Selection Diagram. We are talking about engineering reliability with respect to process conditions like upset scenarios and depressurization rate calculations, which affect material integrity for the design life of the asset in present industrial demand, with optimized material selection along with high-end corrosion and testing requirements.

My journey has been quite diverse, starting from cryogenics with INOX India, moving through global EPC environments like Bechtel and

Technip Energies, and now leading Materials Engineering at Larsen & Toubro Energy Hydrocarbon.

What makes my journey interesting across all my experiences is material selection, corrosion, and coating. Whether it's LNG, offshore, or hydrogen, the core challenges revolve around corrosion, integrity, and reliability. Over time, these disciplines naturally converged into a more integrated leadership role. It includes advanced welding, advanced NDT, and automation in fabrication and testing.

Every engineering system ultimately fails or survives because of how well we understand materials in their real operating environment.

**Q:** Over the last decade, L&T has been deeply involved in complex EPC/EPCM projects across hydrocarbons, offshore structures, hydrogen, and nuclear. From your vantage point, how has the role of materials engineering, corrosion control, welding, and NDT evolved within project lifecycles?

**A:** Traditionally, engineering relied on compliance with standards such as ASME, ASTM International, and ISO frameworks, which defined boundaries for material selection, corrosion damage mechanism confirmation, welding, and NDT evaluation with respect to the project lifecycle. But modern systems like hydrogen infrastructure, deepwater assets, and cryogenic storage are generally operated beyond static assumptions, and their standards for welding and NDT need to be interpreted based on material behavior and corrosion damage mechanisms.

We are now moving toward materials intelligence for material selection, corrosion damage management, welding, and NDT, where:

- Design is governed by mechanism-based understanding (API 571

- damage mechanisms)
- Integrity is evaluated through fitness-for-service (API 579 / ASME FFS-1)
- Inspection is optimized via risk-based frameworks (API 580 / 581)

So instead of asking, "Is this material compliant?", we ask, "How will this material degrade over 25 years under coupled mechanical, thermal, and chemical loads, and how early can we detect it?" This adds more in-depth understanding for new and running assets for material, welding, and NDT method selection and helps provide correct specifications based on international standards.

**Q:** You've played a critical role in advancing Green Hydrogen and electrolyzer engineering at L&T. From a materials, corrosion, and inspection standpoint, what are the biggest challenges in enabling reliable GH<sub>2</sub>/LH<sub>2</sub> infrastructure — especially around embrittlement, storage, and H<sub>2</sub> pipelines?

**A:** Hydrogen changes the game completely. Hydrogen is not just another fluid; it is an atomic disruptor of material stability.

**We deal with:**

- Hydrogen embrittlement
- Permeation and leakage
- Material degradation under cyclic loading

**At a fundamental level, hydrogen interacts with lattice structures, altering dislocation behavior and fracture resistance:**

- HELP (Hydrogen Enhanced Localized Plasticity)
- HEDE (Hydrogen Enhanced Decohesion)

This leads to macroscopic failures such as:

- HIC (NACE TM0284)
- SSC (NACE MR0175 / ISO 15156)

- Accelerated fatigue crack growth
- From an engineering standpoint, this forces us to rethink:**
- Strength vs. toughness trade-offs
  - Weld metallurgy and residual stresses
  - Barrier coatings and diffusion control

So, material selection is no longer a straightforward decision for metallurgists; it requires deep metallurgical understanding combined with advanced inspection techniques with respect to process conditions.

In hydrogen systems, reliability is not designed at the macro scale but is engineered from the microstructure upward.

**Q:** Coming to cryogenics and LNG/LH<sub>2</sub> systems — domains where INOXCVA, Bechtel, and L&T have significant footprints — how do you view the interplay between Welding, NDE, vacuum systems, helium leak testing, and marine/offshore certification standards for ensuring integrity?

**A:** In cryogenic systems, everything must work flawlessly at extremely low temperatures. The ductile-to-brittle transition temperature is important for inspection and testing. Welding and NDT, including monitoring sensors, play an important role in asset management and are considered advanced NDT in the present scenario.

**In cryogenic systems, especially LH<sub>2</sub>, temperature shifts materials into the brittle fracture regime. This means:**

- High-quality welding with automation
- Advanced NDE like PAUT/TOFD with automation (robots and cobots)
- Helium leak testing for tightness

**Here, classical strength-based design is insufficient. Instead, we rely on:**



- Fracture mechanics (K<sub>IC</sub>, CTOD, J-integral)
- ASME Section VIII Div 2 (Design by Analysis)
- Impact toughness validation (ASTM E23)

Welding becomes a critical variable not just for strength, but for:

- Microstructural integrity
- Residual stress distribution
- Crack initiation resistance

And then comes leak integrity because, in LH<sub>2</sub> systems, even microscopic leakage is unacceptable. Helium leak testing down to 10<sup>-9</sup> mbar·l/s sensitivity becomes not just a QA tool but a design validation philosophy.

It's really about ensuring zero-failure-tolerance systems.

Regarding marine offshore certification standards for ensuring asset integrity, significant innovation in welding, NDT testing, and asset management has been implemented by AMPP, ASME, DNV, Norsok, and

many end-user specifications. Aging industries also require more advanced welding, such as underwater welding, robotic welding, and NDT methods where no-man-zone concepts are emerging for subsea applications with high-tech sensors providing real-time data.

**Q:** Across offshore jackets, topsides, risers, and subsea assets, standards like Norsok and DNV drive strict compliance. How do integrity engineering, cathodic protection (CP), coatings, advanced NDE, and materials selection come together in offshore qualification and procurement decisions?

**A:** Offshore is one of the harshest environments. Standards like AMPP, DNV, and Norsok push us toward excellence.

**Offshore assets represent one of the most complex engineering environments:**

- Mechanical fatigue from cyclic loading
- Chloride-driven corrosion
- Microbiologically influenced corrosion (MIC)
- Cathodic protection interactions

Standards like DNV and Norsok don't just enforce compliance but also embed experience from decades of failures and learnings. It's a complete ecosystem of integrity management.

What's critical here is integration:

- Advanced materials (duplex, super duplex, CRA)
- Coatings (ISO 12944, Norsok M-501)
- CP systems (DNV-RP-B401)
- Advanced inspection strategies with high-end technologies (i.e., advanced NDT)

This is where integrity engineering becomes a systems engineering discipline for offshore material qualification and procurement actions. With these international standards, offshore material procurement is a challenge considering very stringent specifications for steel material grades, surface preparation and coating requirements, NDT, etc., based on DNV and Norsok standards that must be followed strictly.

**Q:** You've worked with licensors, IOCs, EPC/EPCM players, and global suppliers—from Aramco and Shell to BP, ExxonMobil, Total, and others. When selecting NDT vendors, inspection technologies, or materials solutions for such projects, what criteria become non-negotiable?

**A:** When working with global leaders like Saudi Aramco, Shell, or ExxonMobil, there's no compromise.

**Key expectations for selecting NDT vendors are:**

- Proven capability with respect to advanced NDT methods



- Trained operators and their interpretation skills with respect to the NDT process
- Calibration of equipment with respect to MOC
- Compliance with global standards
- Reliability and transparency
- Digital record maintenance
- Non-conformance compliance for asset integrity

**Q:** Hydrogen, cryogenics, and offshore are all high-consequence environments. How do you personally evaluate risk vs. inspection strategy vs. lifecycle reliability when deciding between conventional NDT, advanced NDE (PAUT/TOFD), helium leak testing, or emerging digital integrity methods?

**A:** It's always about balancing risk and cost. We evaluate:

- Criticality of assets
- Failure consequences
- Inspection effectiveness

Advanced NDT vs. conventional NDT is about seeing beyond the surface, as modern NDT is no longer just about detecting defects; it is about quantifying uncertainty and enabling predictive decisions.

Take the example of PAUT with FMC/TFM:

- It allows full matrix data capture
- Enables total focusing at every pixel
- Provides near-radiographic resolution

If we consider TOFD:

- It gives precise crack tip diffraction
- Provides reliable sizing independent of amplitude

Based on advanced NDT, we move into:

- Industrial CT → true 3D defect characterization
- Pulsed Eddy Current → corrosion detection through insulation
- Guided Wave UT → long-range screening
- Acoustic Emission → real-time damage evolution

Then we decide between conventional NDT, advanced NDE, or specialized techniques like helium leak testing. Acoustic testing with high-end automation is the demand for future-ready industries.

The real shift in NDT is this: inspection is no longer discrete but is becoming continuous, data-rich, and a physics-informed systematic approach toward determining the remaining design life of assets.





**Q:** You’ve led RBI/RCM/IOW, CP/ICCP systems, corrosion monitoring, and digital integrity dashboards in collaboration with LTTS. Do you believe Digital Twins and predictive corrosion analytics can substantially change how we perform inspection, maintenance, and anomaly detection in the near future?

**A:** Digitalization is transforming everything by converting data into engineering decisions. With platforms like L&T Technology Services (LTTS), we’re moving toward Digital Integrity Architecture:

- Sensor networks (corrosion probes, UT sensors)
- Data lakes integrating inspection history
- AI/ML models predicting degradation
- Digital twins (aligned with ISO 23247)

This enables:

- Remaining Life Assessment (RLA)

- Predictive maintenance
- Real-time anomaly detection

The future engineer will not just interpret data but will interact with digital replicas of assets with respect to RBI/RCM/IOW, CP/ICCP systems, and corrosion monitoring. For more information on RBI and IOW, international standards like API can be referred to, and their data should be systematically collected and used through high-end software available in the market. Similarly, RCM can be studied for rotary, instrument, and electrical assets.

CP systems can be monitored through sensors, and data can be generated for Digital Twin platforms to evaluate protection effectiveness. Corrosion monitoring through sensors, especially in CUI-affected equipment and piping, enables predictive maintenance, particularly when inspections need to be delayed. This requires systematic data analysis for Digital Twin models to track asset

degradation.

This is shifting us from reactive to predictive maintenance.

**Q:** You’ve led RBI/RCM/IOW, CP/ICCP systems, corrosion monitoring, and digital integrity dashboards in collaboration with LTTS. Do you believe Digital Twins and predictive corrosion analytics can substantially change how we perform inspection, maintenance, and anomaly detection in the near future?

**A:** We’ve made progress with respect to new technologies for sure, but challenges remain, especially in:

- Hydrogen-compatible materials requiring clean steelmaking processes, advanced NDT testing, and advanced metallurgical testing laboratories
- Cost-effective alloys with high durability with respect to equipment and piping design life
- Long-term performance validation

- Offshore material selection
- Surface preparation and coating based on ISO 12944 with corrosivity categories such as C5 or C5X
- Cyclic service coating selection from cryogenic to high temperature, which is challenging, especially when operating temperatures do not exceed 100°C

There is still room for innovation based on industrial demand for next-generation advanced materials.

**From your experience across**

**Q:** EPC manufacturing and project execution, how do you see welding automation, qualification standards, and NDE training evolving for the next-gen workforce? Are we prepared for electrolyzer gigafactories, offshore modularization, and nuclear-grade QA/QC expectations?

**A:** The future workforce needs to adapt quickly. We will see:

- Welding automation—where instead of welders, we have welding operators who can perform welding remotely
- Robotics and cobots as new-generation advancements in welding and NDT
- Advanced NDT skills and qualifications playing an important role in asset analysis

Robotics is redefining inspection accessibility where traditional NDT has limitations. Inspection is increasingly moving into environments where humans cannot safely operate. Robotics is addressing this through:

- Magnetic crawlers for tank floors
- UAV drones with LiDAR and thermography
- ROVs for subsea inspection
- Robotic PAUT scanners for automated weld inspection

But the real advancement is not just

mobility—it is integration.

**Welding: The Silent Determinant of Integrity**

Welds are often the weakest link, not because of poor execution but due to:

- Metallurgical heterogeneity
- Residual stresses
- Heat-affected zone transformations
- With increasing automation:
- Orbital welding
- Laser hybrid welding
- Robotic welding

We are improving repeatability but also introducing the need for:

- Advanced qualification (ASME Section IX, ISO 15614)
- High-resolution inspection

Robotics + Welding/NDT + AI = autonomous inspection ecosystems. Training and certification will be critical to meet future demands.

**Q:** You’ve moved through organizations like INOXCVA, Bechtel, Technip, and now L&T—all demanding high discipline in inspection, qualification, and compliance. In your view, what does “best-in-class NDT procurement” look like for large capital projects over the next 5–10 years?

**A:** NDT procurement is evolving based on current industrial demands:

- Digital integration with respect to innovation in NDT testing
- AI-based inspection
- Data-driven decision-making

It’s no longer just about inspection; it’s about intelligence.

**Q:** On a personal note, outside of engineering, corrosion, and hydrogen—how do you unwind? What hobbies or interests keep you energized when you’re not solving reliability challenges at work?

**A:** Outside work, I enjoy learning, mentoring, and staying updated with new technologies. That balance helps me stay energized.

**Finally, if you look ahead—what gives you confidence about India’s position in hydrogen, offshore, EPC, and nuclear materials technology over the coming decade? And what storyline do you believe will define L&T’s contribution?**

**A:** India has a strong opportunity in hydrogen and EPC. With companies like Larsen & Toubro, we are well-positioned to lead globally in engineering and sustainable infrastructure. India stands at a unique intersection of:

- Engineering capability
- Manufacturing scale
- Energy transition momentum

Organizations like Larsen & Toubro are not just executing projects but are building future-ready engineering ecosystems.

**Q:** Before we close—platforms like OnestopNDT aim to aggregate knowledge, bridge stakeholders across NDT, materials, integrity & safety, and democratize access to insights globally. From your experience, how important are such ecosystems for industry collaboration and technology adoption?

**A:** In this rapidly evolving landscape, platforms like OnestopNDT play a crucial role. They enable:

- Connecting industry professionals
- Sharing knowledge globally
- Accelerating innovation
- Knowledge democratization
- Cross-industry learning
- Faster adoption of advanced technologies



Key Insights from the Discussion:

- Hydrogen introduces new challenges like embrittlement and permeability, requiring advanced material strategies
- Offshore and cryogenic systems demand integrated approaches combining materials, coatings, CP, and NDE
- Digital twins and predictive analytics are transforming inspection and maintenance practices
- Future NDT will be driven by AI, automation, and data-centric decision-making

- Workforce readiness in welding automation and advanced NDE is critical

Looking Ahead

India is strongly positioned to lead in hydrogen and EPC, with organizations like Larsen & Toubro playing a key role in shaping the future.

Equally important are platforms like OnestopNDT that enable knowledge sharing and collaboration across the global ecosystem.

Mr. Urvesh's perspectives highlight the ongoing transformation in engineering—from conventional,

compliance-driven practices to integrated, data-driven, and predictive approaches. As industries move toward hydrogen, offshore, and low-carbon technologies, the role of advanced materials engineering, welding, NDT, and digital solutions becomes increasingly critical. His insights emphasize that future-ready infrastructure will depend on innovation, skilled workforce development, and collaborative ecosystems that enable reliability, safety, and long-term asset performance.



# SuperFlex Cables

## by Echo Ultrasonics

- No stiffness, cracking or coiling down to  $-40^{\circ}\text{F}/\text{C}$
- Single and dual UT cables

Request your complimentary cable today – one per facility.



**ECHO**  
ultrasonics

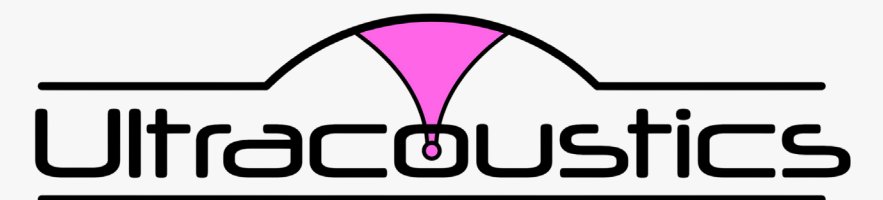
(360) 671-9121 | [echoultrasonics.com](https://echoultrasonics.com)



Startup to Watch



# Beyond the Contact Barrier: How Ultracoustics is Bringing MHz-Range Ultrasonics to Open Air





Startup to Watch

The Problem Every NDT Technician Knows

If you work in ultrasonic testing, you know the routine. Apply couplant. Make contact. Take a measurement. Wipe away the couplant. Repeat. For decades, this workflow has been the price of admission for high-resolution UT. Air-coupled ultrasound has always promised a way around it, but the technology has never completely delivered on that promise. Conventional ultrasound microphones top out around 100 kHz, which is sufficient for detecting gross defects in thick foam or honeycomb panels, but nowhere near the MHz-range frequencies needed for the kind of resolution that serious inspection demands.

Ultracoustics, an Edmonton-based startup, has built a sensor that changes this equation. Their product, BROADSONIC, operates at up to 5 MHz in open air. That is roughly 50 times the bandwidth of conventional air-coupled sensors, and it opens the door to non-contact inspection methods that were previously limited to immersion tanks or laser-based systems.

Optical, Not Piezoelectric

BROADSONIC uses no electrical sensing elements. Instead of piezoelectric detection, it relies on a Fabry-Perot optical cavity - a pair of microscopic mirrors at the tip of a fiber optic cable. When acoustic pressure deflects the cavity membrane, it shifts the optical interference pattern, and that shift is read out as the measurement signal.

The practical consequences matter more than the physics. The active sensing area is only 100 micrometers across, giving it point-sensor resolution and sensitivity that larger piezo elements simply cannot match. It is entirely optical, which means complete immunity to electromagnetic interference. And it covers the full frequency band from near-DC to 5 MHz in every single measurement, so there is no need to swap transducers or repeat scans at different frequencies.

The sensor head is smaller than a pencil tip. The readout unit contains an internal ADC that connects over USB and streams data in real time for easy integration into existing systems.

Seeing Inside a Spot Weld Without Touching It

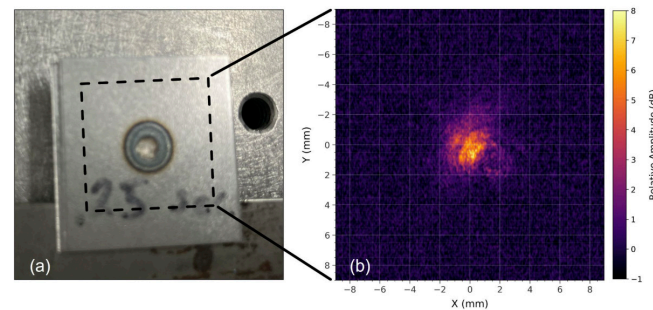
To demonstrate what MHz-range air-coupled sensing makes possible, Ultracoustics recently scanned a spot weld joining two bonded sheets of 0.030" cold-rolled mild steel.

The setup used BROADSONIC as the receiver & a simple excitation source on the opposite side of the plates (no coupling fluid involved anywhere in the measurement chain). The sensor was raster-scanned across the weld region, capturing the acoustic transmission at each point. The broadband capability of the BROADSONIC offers potential for rapid, in-line QC of spot welds in a production environment.

The resulting image clearly reveals the weld nugget as a region of high acoustic transmission, surrounded by unbonded sheet metal where transmission drops off. The boundary between welded and unwelded material is visible with sub-millimeter clarity.

For anyone who has spent time doing spot weld QC, this is significant. Current methods are either destructive (peel tests, chisel tests) or require contact ultrasonics with couplant applied to every individual weld by a skilled technician. On a high-volume production line, that is a bottleneck. A non-contact, air-coupled method that can image the weld nugget at production-relevant resolution is ready for automation and robotic integration, bringing inline weld verification within reach.

"This is ultrasonic imaging done above 1 MHz in air, without contact or coupling fluid," says Kyle Scheuer, CEO of Ultracoustics. "A technician can set this up on a production line, point it at a weld, and get a broadband acoustic measurement in air. It opens up inspection scenarios that practitioners have been told are not possible with air-coupled methods."



Non-contact imaging of spot weld quality. (a) two pieces of 0.03" cold-rolled mild steel spot welded together. (b) An ultrasonic map generated by scanning BROADSONIC near the surface of the steel.

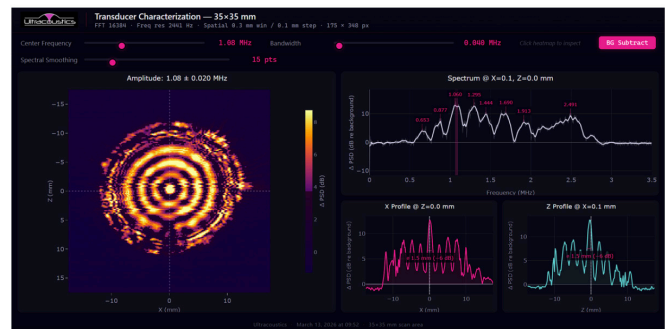
Transducer Characterization: Know What Your Equipment Is Actually Doing

While the NDT inspection capabilities continue to develop, Ultracoustics has already brought one application fully to market: transducer characterization as a service.

NDT technicians rely on transducers daily, yet few have ever seen a complete spatial map of what their transducer's beam actually looks like across its full frequency range. Hydrophone scanning requires water immersion and delivers one frequency per pass. Laser vibrometry costs six figures and measures surface velocity rather than radiated pressure. Most transducers in the field are effectively black boxes - you trust that the spec sheet is correct and hope for the best.

BROADSONIC captures the entire 0-5 MHz spectrum at every spatial point in a single pass. One scan produces a complete picture of how a transducer radiates acoustic energy, at every frequency, at 0.1 mm resolution. Scanning square-centimeter areas is fully automated and takes minutes.

The results are delivered as interactive HTML reports that open in any browser. Users can slide through frequencies in real time, click any pixel to see its full spectrum, view cross-sectional beam profiles, and export raw data, without proprietary software or license fees. The report is self-contained and shareable.



Piezo transducer characterization done using BROADSONIC. Each pixel contains a full 0 – 5 MHz spectrum, allowing the entire frequency response and mode patterns to be obtained from a single scan.

The service is straightforward: ship your transducer to Ultracoustics in Edmonton. Results are returned within one week and the transducer is returned. For transducer manufacturers, this is a QC tool that replaces days of hydrophone scanning with a single broadband pass. For NDT service companies, it is a way to verify that inspection equipment is performing as expected, not just calibrated, but actually characterized.

Built in Alberta's Deep-Tech Ecosystem

BROADSONIC did not originate in a corporate R&D lab. The sensor technology was developed at the University of Alberta, where CTO Dr. Ray DeCorby, a professor of Electrical and Computer Engineering, built the underlying optomechanical platform. The sensors are fabricated at the university's nanoFAB facility, one of Canada's leading nanofabrication centers.

The company is backed by Alberta Innovates, Emissions Reduction Alberta, the National Research Council of Canada, and Mitacs. Its team operates out of Edmonton, and the technology, from sensor design to fabrication to final assembly, is entirely Canadian.

"The sensors are designed, fabricated, and assembled here in Edmonton," says Scheuer. "The research was done here. The IP is here. This is Alberta deep-tech from the ground up."

Not Just a Sensor, but a Platform Technology

While NDT and transducer characterization are the company's primary commercial focus, BROADSONIC's broadband optical sensing has also demonstrated capability in adjacent industrial applications: ultrasonic gas leak detection in noisy plant environments, real-time cavitation monitoring for ultrasonic cleaning baths, and non-contact partial discharge detection for electrical infrastructure. Each leverages the same core advantage; broadband, non-contact, EMI-immune acoustic sensing that captures what conventional sensors miss.

With over 10 peer-reviewed publications in journals including JASA, Applied Physics Letters, Nature Microsystems & Nanoengineering, and Optica, the science behind BROADSONIC has been validated by the research community. The commercial question is now about scale and adoption. Ultracoustics is currently working with early partners in automotive, semiconductor, and transducer manufacturing to validate BROADSONIC for specific inspection workflows.

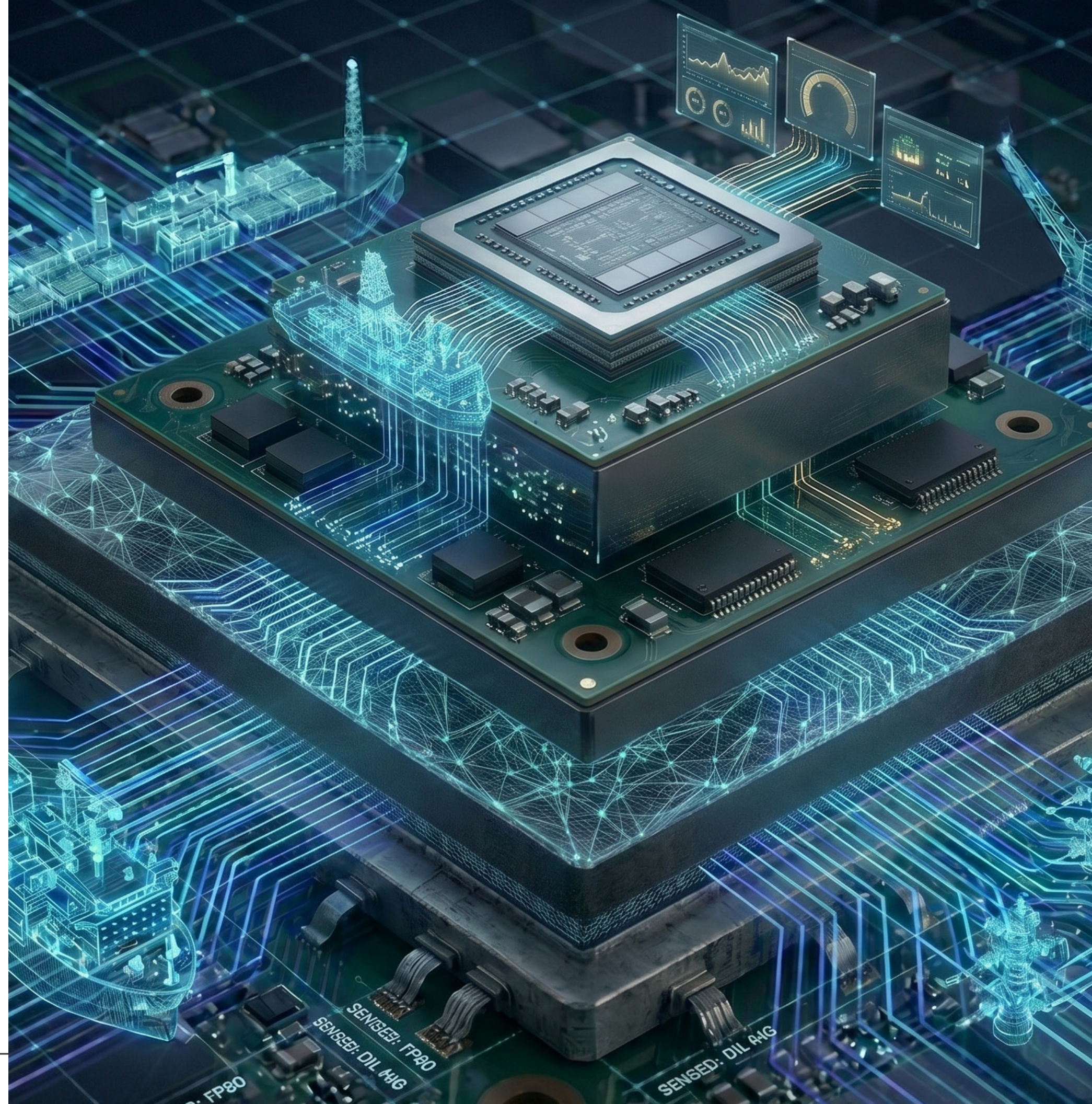
To request a transducer characterization scan or explore how BROADSONIC could fit into your inspection workflow, contact the team directly at kyle@ultracoustics.ca or visit ultracoustics.ca.

Learn More



# Application of AI and Digital Twin Technology for Large-Scale Offshore Inspection and Maintenance

ABYSS





Case Study

**In** 2026, the global asset integrity and Non-Destructive Testing (NDT) industries are experiencing a significant technological transformation driven by Artificial Intelligence and digital twin infrastructure. Conventional manual inspections are swiftly being replaced by autonomous data capture systems that utilize computer vision to remove human bias, significantly lower operational expenses, and improve site safety. The global predictive maintenance market is witnessing explosive and consistent growth. This impressive economic expansion is propelled by the industry's urgent need to minimize equipment downtime and refine maintenance scheduling, which leads to substantial savings on operational costs. With stricter regulations and a growing focus on safety being reinforced each year, continued investment and expansion in such technology is to be expected. Abyss Solutions is at the forefront of this change in the energy sector with Abyss Fabric, a comprehensive digital inspection platform powered by AI.

Company Profile: Pioneering Autonomous Inspections at Scale

Abyss Solutions is a pioneer in

autonomous inspection. With industry 4.0 well underway, Abyss provides the software solution that allows autonomous robots to acquire, process, and analyze data on a large scale. The foundational purpose of Abyss is rooted in sustainability: to protect and conserve the world's most valuable resources for generations to come. By actively preventing Loss of Primary Containment (LOPC) events and reducing the necessity for fuel consumption, such as offshore helicopter flights, Abyss actively assists multinational corporations in exceeding their health, safety, and decarbonization targets. The overarching corporate vision is to pioneer autonomous systems to enable structural inspections at an enterprise scale.

We are headquartered in Houston, Texas, which is the epicenter for our interactions with the global oil and gas industry. To support its rapidly expanding international clientele, Abyss maintains dedicated regional offices in the United Kingdom, Australia, Brazil, Pakistan, and the United Arab Emirates. A critical market differentiator at Abyss is our world-class Research and Development (R&D) center located in Sydney, Australia. The R&D division focuses heavily on advancing autonomous perception systems and Artificial Intelligence applications across multiple sectors with a focus on the energy and infrastructure sectors.

The Problem Statement: Critical Vulnerabilities in Traditional NDT Methodologies

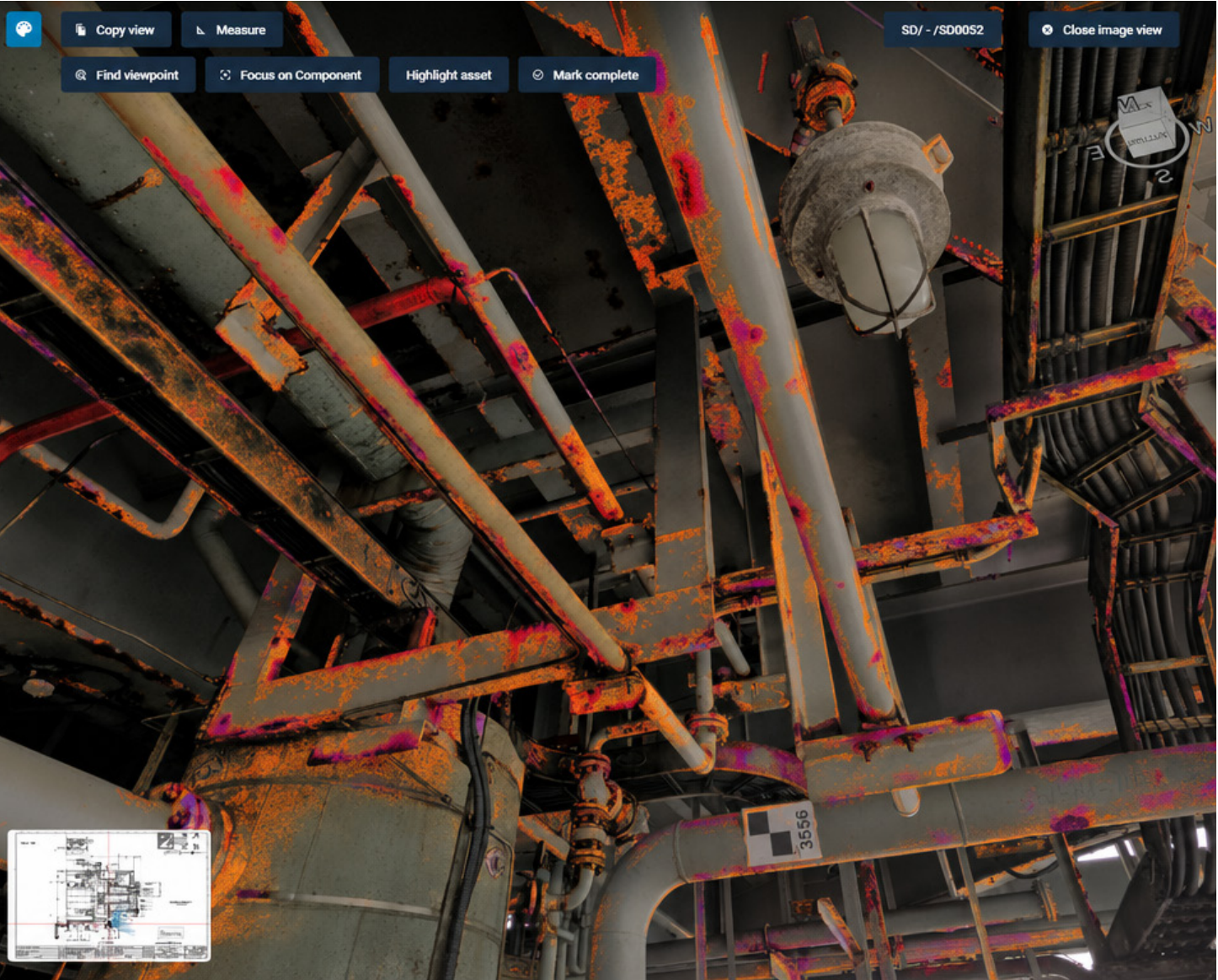
The ongoing dependence on outdated inspection methods within modern industrial settings has

unintentionally led to a range of escalating structural and operational weaknesses. The issues associated with traditional approaches to Risk-Based Inspection and Fabric Maintenance can be broadly identified as significant logistical inefficiencies, excessive data subjectivity, and critical safety risks that endanger human lives.

Floating Production Storage and Offloading (FPSO) facilities are among the most vital, high-value, and intricate assets in the offshore energy industry. These large vessels face extreme production demands and are continually exposed to harsh marine conditions, which render their hulls and topside equipment vulnerable to damages like blistering, pitting, and rapid coating deterioration. Presently, FPSO operators worldwide are encountering a widespread trend of unmanageable maintenance backlogs. The main operational constraint fueling this issue is the strict limitation on Personnel on Board (PoB). Offshore facilities have fixed capacity limits and must prioritize operational personnel to ensure continuous production, leaving little room or logistical capability to support large teams of scaffolding contractors, rope access technicians, and NDT inspectors.

Furthermore, manual physical inspections yield notoriously poor total asset coverage. Regulatory codes often mandate the visual inspection of all pressure equipment every five years. Due to the sheer, overwhelming scale of the facilities, operators typically only possess the manpower to inspect 20% of the equipment annually. This staggering statistic means that for four out of the five years in a standard inspection cycle, an operator has absolutely zero visibility into the true physical condition of 80% of their critical assets.

The most significant and dangerous flaw in manual General Visual Inspection (GVI) is inherent human subjectivity. Two highly trained, certified inspectors assessing the



exact same pipeline may grade the severity of atmospheric corrosion entirely differently based on their individual experience levels, cognitive fatigue, or simply the ambient lighting conditions at the time of the inspection. This highly subjective, inconsistent data into databases, leading to corrupted historical records and deeply flawed temporal analysis models.

The inspection of specific structural components, such as active flare stacks, significantly amplifies the profound limitations of manual NDT. Flare stacks operate at extreme temperatures and continuously discharge hazardous gases. Traditional condition monitoring requires personnel to physically climb the stacks using ropes and safety harnesses, battling scorching heat, toxic emissions, and severe offshore weather conditions. Human inspectors simply cannot safely access certain angles or complex structural geometries of the tower, and the mechanical integrity of the stack is left up to question.

The Solution: Abyss Fabric and the Digital Twin Ecosystem

Abyss Solutions' advanced offering is Abyss Fabric, a cloud-based software platform that generates interactive 3D digital environments overlaid with AI-based corrosion analytics. By utilizing 3D modeling, terrestrial laser scanning, and machine learning analytics, Abyss Fabric enables operators to digitally contextualize asset health, identify atmospheric corrosion with sub-millimeter precision, and prioritize structural remediation.

The platform operates on a three-step methodology: **Acquire:** To achieve comprehensive data acquisition, Abyss utilizes advanced data capture techniques, primarily leveraging Terrestrial Laser Scanning (TLS) and multi-rotor UAVs.



**Analyze:** We process massive datasets using computer vision and machine learning algorithms.

**Act:** Engineers can thoroughly evaluate the data remotely from anywhere in the world, securely accessing the unified platform via the cloud.

Real-World Evidence:  
Comprehensive Case Studies in  
the Energy Sector

The capabilities of Abyss Solutions are validated through extensive real-world deployments.

■ Case Study 1: Neutralizing Backlogs in the Gulf of America

A major customer operating in the GoA had recently acquired a massive portfolio of aging offshore oil and gas platforms. They immediately faced a challenge: an entirely unmanageable backlog of highly corrosion-prone equipment awaiting urgent inspection. Based on conventional inspection regimes, clearing this backlog would take a minimum of 4 to 5 years, creating an unacceptably high risk for a highly costly and environmentally catastrophic LOPC event.

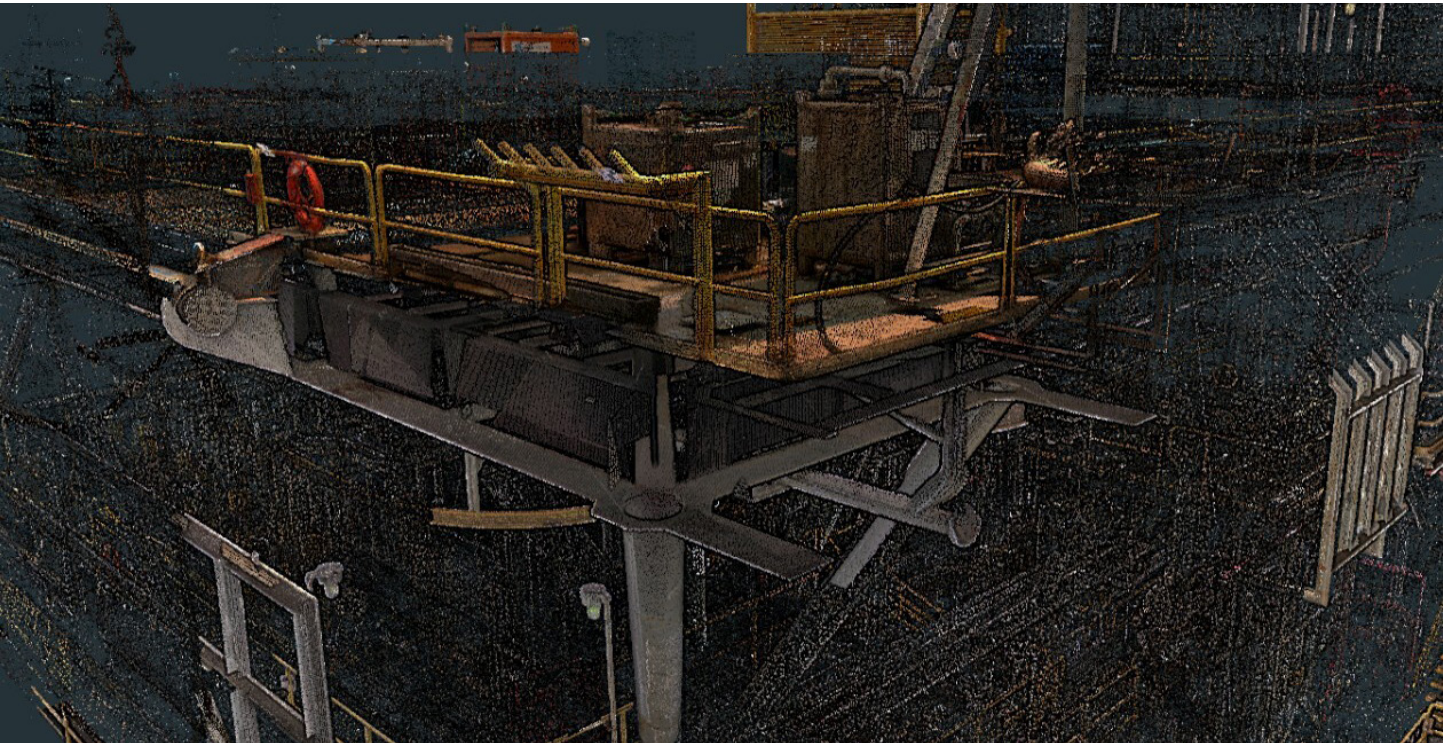
Abyss rapidly deployed its data capture teams and utilized the advanced Abyss Fabric platform to create comprehensive digital twins of the assets. Through artificial intelligence and humans in loop, we conducted detailed, highly rigorous visual inspections entirely virtually from corporate computers

on the opposite side of the globe. Within a matter of mere months, the customer achieved highly meaningful, actionable data coverage across 95% of the massive platform. The deployment drastically reduced inspection OPEX, and the highly impressed customer rapidly expanded the project contract to encompass an additional 10 offshore platforms.

■ Case Study 2: Aggressive Corrosion Combat on a 10,000-Tonnage Semi-Submersible

In another major Gulf of America deployment, Abyss implemented its advanced AI system on a 10,000-tonnage semi-submersible platform capable of producing 80,000 barrels of oil per day. Traditionally, the operator's highly expensive manual GVI campaign covered only a concerning 20% of the equipment annually. In just 14 days, a highly efficient team of five scanning personnel successfully captured the entire, sprawling facility using terrestrial laser scanners.

The raw spatial data was rapidly processed using Abyss's Machine Learning algorithms. The AI system achieved a 97% coverage, an 77% improvement over the manual baseline. The AI analytics successfully identified 83 highly critical nominations for urgent equipment replacement, representing vital components with an estimated time-to-failure of merely 6 to 12 months. The direct remediation cost for replacing these 83 items was approximately \$15M USD, preventing catastrophic operational shutdowns that would have likely occurred under their previous 20% manual coverage strategy.



The Value  
Proposition:  
Quantifying Risk  
Reduction and ROI

When global industrial organizations fully leverage Abyss Fabric, they achieve what the industry widely recognizes as a genuine, change in their total asset integrity strategy.

■ **Asset Visibility:** The Abyss digital twin approach achieves up to 95% coverage of a massive asset within a matter of months.

■ **Financial ROI:** The efficiency of remote, AI-driven analysis yields an overall cost reduction of up to 60% for combined inspection and maintenance operations. By accurately identifying necessary remediation volumes and scopes, operators drastically slash labor hours and wasted material costs.

■ **HSE Advancements:** By completely digitizing the physical facility and securely managing structural data analysis onshore, operators achieve a reduction in Personnel on Board (PoB) requirements. Removing human inspectors from extreme offshore hazards directly leads to a reduction in the overall risk of human exposure to injury.

■ **ESG and Decarbonization:** Optimizing logistical resource deployment directly impacts an organization's total carbon footprint. By drastically reducing the frequency of offshore helicopter flights and vessel mobilizations, Abyss assists major energy companies in meeting their strict global decarbonization mandates.

■ **Mitigating Critical Failure:** Through comprehensive data coverage, highly objective AI anomaly detection, and accurate blister height wall-loss estimations, Abyss Fabric demonstrably reduces the severe



risk of Loss of Primary Containment (LOPC) and the overall risk of sudden structural failures.

Abyss Solutions has proven that the deep integration of data capture, digital twins, and advanced machine learning analytics is the future. By continuously providing objective intelligence that spans, Abyss Solutions is fundamentally redefining the standard for industrial safety and mechanical reliability in the AI era.

Conclusion

As the highly complex asset integrity industry advances rapidly through 2026, the archaic era of highly subjective, deeply manual, and incredibly hazardous general visual inspections is drawing to a close. The compounding pressures of aging infrastructure, decarbonization mandates, and the catastrophic financial risks associated with unplanned downtime demand a significantly more sophisticated approach to maintenance.

Learn More



# Nondestructive testing methods for rail defects detection

Ravikant Mordia, Arvind Kumar Verma

## Abstract

The rapid progress in the construction of heavy-haul and high-speed railways has led to a surge in rail defects and unforeseen failures. Addressing this issue necessitates the implementation of more sophisticated rail inspection methods, specifically involving real-time, precise detection, and assessment of rail defects. Current applications fail to address the evolving requirements, prompting the need for advancements. This paper provides a summary of various types of rail defects and outlines both traditional and innovative non-destructive inspection techniques, examining their fundamental features, benefits, drawbacks, and practical suitability for railway track inspection. It also explores potential enhancements to equipment and software. The comprehensive review draws upon pertinent international research and review papers. Furthermore, the paper introduces a fusion of inspection methods aimed at enhancing the overall reliability of defect detection.

## 1. Introduction

There has been a rapid increase in train density in recent years, load capacity, and running speed within railway transportation, particularly in high-speed railway transportation [1]. The significance of railway transportation in the modern transportation system has grown considerably. Consequently, there is an escalating concern for rail safety [2]. Rails endure substantial mechanical loads and challenging environmental conditions as a routine part of their operation. The wheels' weight is the main source of mechanical stresses, which puts rolling contact pressure and shear and bending pressures on the rails [3]. Additionally, rails are consistently exposed to natural elements, resulting in phenomena such as corrosion and thermal stress. Notably, thermal expansion has a substantial impact on ideal and flawless rails used in high-speed railways, influencing the

concentration of internal stress within the rail structure [4]. Rail defects are primarily found in various sections of the rail, including the rail's head, its web, foot, and specific areas. The stress concentration is notably pronounced on the rail's head [5]. Thus, common Rolling Contact Fatigue (RCF) flaws include cracks, stripping, corrosion, wear, crushing, shelling, and internal damage, all of which are mostly visible on the outside and within the rail-head. Significant defects including cracks, severe corrosion, and bolt-hole fatigue, can occur in the rail-web. The two main defects found in the rail foot are cracks and rust. Moreover, the complexity of defect types increases on other rail parts, such as welding joints and turnouts [6].

The rail, a crucial component of the railway track, is vitally important for ensuring the safety of train operations and passenger comfort. Consequently, it becomes imperative to conduct timely inspections of the rail using diverse devices employing Non-Destructive Testing (NDT) methods [7].

Conventional inspection methods for railway track inspection are not only time-consuming and labor intensive but are also susceptible to various factors like challenging environmental conditions and inspector experience. In contrast, NDT facilitates rapid detection of rail defects, offering standardized and efficient inspections that minimally disrupt regular operations [8].

Search, identification, and evaluation are the three main processes in the typical NDT rail defect detection method. An array of NDT techniques is used in the search phase to cover every facet of the rail, including the internal components, foot, head, surface, and subsurface. The process of identification involves computing outcomes using quantitative traits obtained from NDT data. Lastly, evaluation includes determining the extent of rail flaws and classifying them according to predetermined standards and indicators [9].

With an increasing demand for comprehensive, rapid, and accurate rail defect detection, and to provide valid and scientific information, testing methodologies must be evaluated against current field applications before this goal can be accomplished.

This paper provides a summary of rapid rail defect detection technologies, examining the advantages and limitations of different NDT methods. The benefits of combining the various NDT techniques are then integrated to create a comprehensive detection guideline.

Rail defects can be categorized according to their location as either internal defects (caused due to rail manufacturing defects or during the service), or surface defects (caused by rail wear and fatigue). Though different countries may adhere to their classification standards, the common type of defects generally remain consistent across regions.

Internal defects originate within the rail, encompassing transverse defects, rail bottom cracks, bolt hole cracks, longitudinal defects, and other variations (Fig. 1). These defects progress discreetly and pose a significant risk of causing hazardous derailments.

Surface defects, in contrast, manifest on or just beneath the rail's surface and encompass issues like squats, shelling, head checking, rail indentations, wheel burns, and other anomalies (Fig. 2). The majority of head checking defects are categorized as RCF cracks, a kind of surface defects that is extremely dangerous. These surface irregularities have the potential to disrupt ultrasonic rail flaw detection, leading to the possibility of the rail failing to identify internal defects [9].

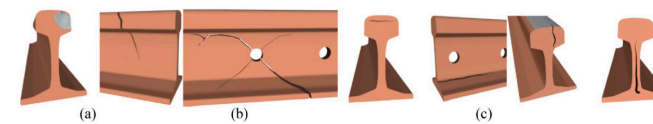


Fig. 1. Internal defects in rail: (a) transverse defects, (b) bolt hole cracks, and (c) longitudinal defects.

## 2. Non-destructive testing methods for railway track defects detection

NDT methods employed for detecting rail defects, can be divided into two primary categories: Visual Testing (VT) and physical inspection. VT relies on various image processing techniques to segment and identify rail images, thereby extracting sufficient defect-related information. Conversely, physical inspection utilizes a variety of physical signal processing techniques to examine the rail. This section will elaborate on each category, outlining its types and primary characteristics.

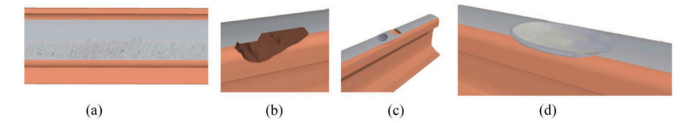


Fig. 2. Rail surface defects: (a) spalls and gauge corner checking, (b) shelling, (c) squats, and (d) wheel burn defect.

### 2.1. Visual testing method

The visual inspection technique represents a non-contact method extensively employed in NDT due to its rapidity and precision [10]. In the context of railway track fault detection, visual inspection relies on utilizing a high-speed camera that has the capability to capture high-quality images of the rail and its components, particularly its surface, while the train traverses the track. Subsequently, the captured image data is transmitted to a computer through a data acquisition device. Following this, specialized software processes that image data to ascertain the appearance of any defects on the rail. Visual inspection is adept at identifying surface irregularities such as corrosion, cracks, deformations, wheel burn, etc., on the rail. The basic principle of VT is depicted in Fig. 3.

From Fig. 3, it is evident that the visual system initially extracts the image of the rail surface. Subsequently, the image is converted to grayscale to facilitate the detection of defects with high contrast.

Automated visual inspection systems are crucial when it comes to tracking elements such as rail head profile, surface damage, missing bolts, pincers position, rail gap, moving sleepers, base plate condition without ballast, lack of ballast, and wear percentage, automated visual inspection systems are essential. A variety of inspection types and needed resolution quality can affect the testing/inspection speed, which can range from 1 to 320 km/h [11].

VT of rails can be inaccurate for a number of reasons. First, because of blurring effects due to camera movement, high quality movies or pictures are needed to provide data that is reliable for analysis [12]. Secondly, conventional cameras lack the capability to capture image data about the depth. Thirdly, changes in environmental light throughout the day significantly affect the captured image data, impacting the defect detection stability. To address these issues, several research have been carried out.

Color line scan cameras and spectral image differencing techniques have shown promise in identifying rail surface flaws, which resolves the first problem. Cameras with powerful scanning functions and excellent image clarity, such as Charge-Coupled Device (CCD) cameras, are utilized for visual inspection, offering a high signal-to-noise ratio and high sensitivity in captured images. A/D converters,



data storage units, timing generators, and other control logic are used in the acquisition of pictures using linear CCD image sensors [13]. Following the digital signal conversion of the images, the rail surface fault identification process is carried out. 120 km/h is the validated speed of non-contact and dynamic rail fault inspection systems using fast line matrix CCD camera technology [14]. For real-time detection, data analysis and inspection speed must be balanced. To determine the sections of the railway track that are problematic, offline data analysis can be carried out if real-time evaluation is not feasible [15]. Notable rail inspection vehicles, such as the VIS integrated rail inspection system by ENSCO and the Rail Check created by Alias Elektronik in Germany, use cutting edge camera technology to automatically identify faults in the rail system [16].

3D vision technologies, such as 3D structured light technology and binocular stereo vision, have been gradually used to address the second issue. Using two images of the rail to be measured taken from various angles, Binocular Stereo Vision uses the parallax principle to derive the object's 3D geometric information by calculating the position variation between matching spots in the images. In order to get 3D information of modulated images through visual modeling and image processing, the 3D structured light camera illuminates a structured light illumination pattern onto the target object [17].

As for the third problem, the camera can scan the rail surface under linear laser illumination, thus integrating machine vision with 3D linear laser inspection technology helps partially offset the impacts of light changes [18]. In locations where light changes, algorithmic processing of picture data can further increase the accuracy of visual inspection for rail concerns. Various image processing techniques, including quantification, feature extraction, defect categorization, and pre-processing, are used in the procedure. Pre-processing typically includes grayscale adjustments, image enhancement, and image segmentation. Rail extraction strategies remove sub-images, which enables the local normalization procedure to improve the contrast of the rail image [19]. The algorithm's fine extractor distinguishes between actual faults and noise spots from anomalies acquired by pre-processing the image data. The coarse extractor uses this information to find flaws in the rail surface image. Feature extraction involves characterizing defects using algorithms such as Local Binary Pattern, Directional Chain Codes, and Histogram of Oriented Gradient [20]. Rail fault inspection has been subjected to several algorithms, including as K-means and decision trees, in order to improve classification accuracy. Due to the system's

capacity to interpret images quickly, flaws may be quantified using the learning-from examples approach [21]. As a type of supervised learning, deep learning detection techniques efficiently recognize fresh picture samples by gaining knowledge from large amounts of image data. They exhibit better generalization and robustness compared to traditional methods [22].

In summary, VT method of rails demonstrates high speed and accuracy. However, it has limitations as it is not capable of detecting microcracks and internal defects. Therefore, it cannot replace ultrasonic inspection.

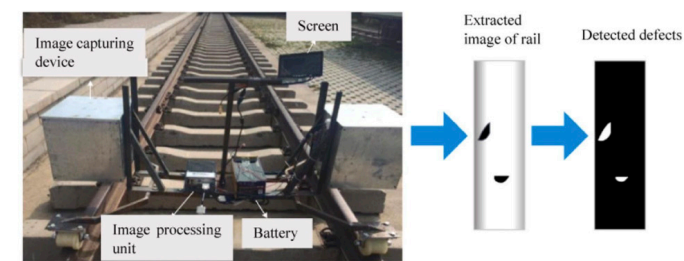


Fig. 3. Visual testing of railway track.

2.2. Ultrasonic testing method

Currently, Ultrasonic Testing (UT) technology for rail defects is in constant development and improvement, featuring numerous applications in this field [23]. An ultrasonic transducer, pulser/receiver, and display unit are the standard components of the UT system, as shown in Fig. 4. In order to drive the transducer and produce high-frequency ultrasonic energy, the pulser/receiver functions as an electronic device that generates high voltage electrical pulses. The most often utilized ultrasonic frequency range for rail fault detection is 0.2–25 MHz, with a range of 0.5–10 MHz. When this acoustic energy is added to the substance, it passes through it as a wave. A portion of the energy reflects back to the transducer from the material's surface if there are flaws present along the wave path. The electrical signal produced by the transducer from the reflected wave signal is shown on a screen for study [24].

The traditional UT approach for detecting rail defects relies on the ultrasonic pulse-echo technique, primarily designed for identifying internal defects existing within the rail structure. This method finds widespread application in various UT equipment's, including rail testing vehicles, dual-rail ultrasonic flaw detectors, and walking sticks.

For instance, the Ultrasonic Flaw Detector (USFD) double rail tester, as illustrated in Fig. 5, conforms to the Research Designs & Standards Organization specifications (M&C/ NDT/130 & 128) set by the Ministry of Railways through the Railway Board of India [25]. This USFD operates

autonomously with a defect display that is divided into two sections: the top half for the RH Rail, and the bottom half for the LH Rail on the screen. The trolley ensures smooth and balanced movement on the track, incorporating automatic gauge tracking. It features two metallic water tanks, each with a capacity of 20 L. Despite its light weight yet robust design, the overall weight, excluding water but including the battery, is approximately 65 kg. It utilizes 18 pulse-echo probes positioned at desired angles, with every probe corresponding to a specific rail defect. Information from the 18 channels is differentiated by the B-scan image's relative position and color. This principle is applicable to rail defect detection vehicles and walking sticks as well.

Rail inspection can be done either by manual ultrasonic inspection or by a specialized test vehicle. Nevertheless, conventional UT faces various limitations. Firstly, its speed is restricted, and long-distance detection is impractical as the coupling agent is required to fill the gap between the measured surface and the probe. Experimentally verified inspection speeds with conventional ultrasonic NDT range only from 40 to 80 km/h, with real-world speeds potentially of 15 km/h, especially during manual verification of the vehicle [26]. Secondly, the rail defects detection with intricate or irregular shapes poses a challenge due to the constraints of ultrasound inspection systems with conventional multi-probe. The third issue is that the defects on the rail's top surface and sub-surface due to fatigue damage are challenging to precisely detect and assess. Fatigue cracks on the upper surface impede the incident ultrasonic wave's ability to penetrate the measured components, which has an adverse effect on the identification of interior flaws hidden underneath the crack. Longitudinal defects reflect ultrasonic waves, which hinder the sound beam's incidence and make dangerous defects hidden underneath them difficult to detect, especially when the defect is close to the horizontal gauge angle [27].

In response to the limitations of conventional ultrasonic NDT methods, various innovative techniques have emerged, including laser ultrasound technology, electromagnetic ultrasound technology, ultra sonic guided-wave inspection technology, and ultrasonic phased-array inspection.

Multiple arrays of independent piezoelectric wafers are utilized in the ultrasonic phased-array inspection. Controlling the position and direction of the spotlight through specific rules and timing sequences enables the effective detection of internally complex-shaped defects with high accuracy. Automated ultrasound systems with phased-array probes are replacing the conventional multi-probe ultrasonic inspection systems that can perform numerous tasks, enhancing the

speed and accuracy of detection. Particularly in specific areas like welds, ultrasonic phased-array inspection has demonstrated superior efficiency compared to traditional ultrasonic inspection methods [28].

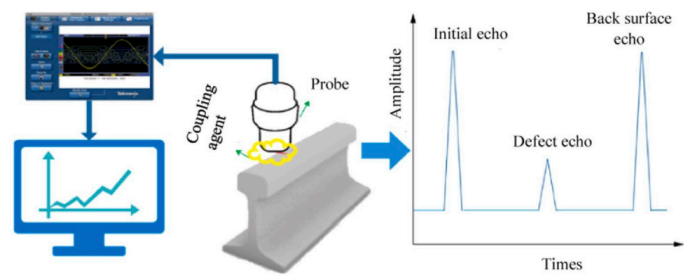


Fig. 4. Basic principle of UT.

Guided waves, a variant of long-range ultrasonics, demonstrate effectiveness within distances of up to 30 m by utilizing the reflection or transmission of ultrasound waves across semi-infinite or two semi-elastic media surfaces. When encountering boundaries such as steel rails, different waveforms propagate at their inherent speeds, resulting in the generation of ultrasound-guided waves. Ultrasonic guided-wave inspection technology capitalizes on low-frequency ultrasonic waves, offering advantages such as extended propagation distances and rapid speed. The G-Scan rail ultrasound-guided wave inspection device developed by British Rail Network Rail employs low-frequency ultrasound-guided waves to detect defects in aluminum thermal welds across expansive distances. Despite potential signal attenuation influenced by various factors, the selection of wave frequency and mode significantly impacts the effectiveness of the inspection range.

Electromagnetic ultrasound technology generates high-frequency currents through a zigzag coil, inducing eddy currents on the rail's head surface. The resulting high static magnetic field causes vibrations, producing electromagnetic ultrasound surface waves.

Learn More



## Veo3 TFM

Live TFM, multi-scan capabilities, and fast, precise results. Inspect confidently with Veo3.

Learn more



## EVIDENT

### What the Experts Use

NEW OmniScan™ X4 128:128PR\*

\*Patent Pending

Learn More >>



## Portable HD Industrial Endoscope

Inspector Plus with HD Revolution



## THORNETIX

SMART THINKING

### Lighter To Carry Easier To Use

A compact wireless UT system designed for long inspection days, vertical climbs, and repeated measurements.

Discover Now



## SPA

InnoVision

### Intelligent NDT Management from Site to Report

Software designed for long-term asset monitoring and evaluation.

Explore Now



## THE REAL FLEXIBLE DIGITAL X-RAY DETECTOR

TRUST THE ORIGINAL!

### HD-CR 35 NDT

COMPUTED RADIOGRAPHY SYSTEM

- ✓ Unique 30 µm basic spatial resolution
- ✓ Scans flexible imaging plates up to 35 cm in width
- ✓ Widest range of applications thanks to Trefoc Technology
- ✓ Intuitive handling & easy transition from film
- ✓ Portable and compact (17.5 kg)
- ✓ Powerful D-Tect X software



## NEW

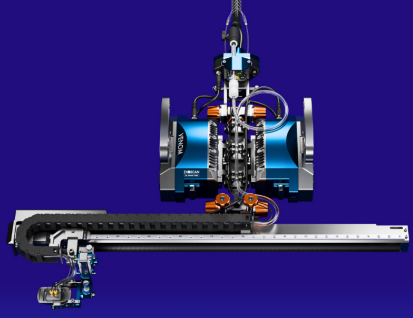
### Meet Venom

Flexible by design, tough by nature.

EKOSCAN

AVT SOCOMATE SSGNET

ekoscan-ndt.com  
contact@ekoscan.fr



## BonPEC

Innovative State-Of-The-Art  
Pulsed Eddy Current Technology

ETHER NDE



NEW!

9.53 mm

LEARN MORE >>

## CarestreamNDT

At Carestream NDT, we're committed to continuous innovation to create a safer world.

Fieldview is an acquisition and validation software extension of Carestream NDT's powerful INDUSTREX suite. Provided on a rugged, industrial-grade tablet with an intuitive touch screen, it simplifies image acquisition in hard-to-reach places.

Fieldview enables digital radiographic image review right at the inspection point. Verify ID's, markers, proper positioning and IQI sensitivity before moving to the next exposure. Instantly adjust and retake or wirelessly transfer the image immediately to a nearby review station for interpretation.

LEARN MORE

CARESTREAM NDT AND YOU.  
WE'RE BETTER TOGETHER.

Carestream



## COMPLETE SOLUTIONS FOR ULTRASONIC TESTING

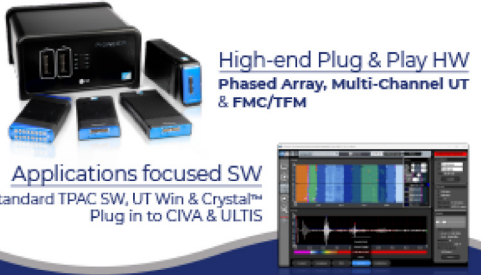
High-end Plug & Play HW  
Phased Array, Multi-Channel UT  
& FMC/TFM

Applications focused SW  
Standard TPAC SW, UT Win & Crystal™  
Plug in to CIVA & ULTIS

TPAC

UNIQUE  
IN NDT

www.tpac-ndt.com  
contact@tpac-ndt.com



## GAM CPR

Close Proximity Radiography

GammaTec

CPR is "The conducting of radiography in close proximity to authorized radiation workers, members of the public or radiation sensitive monitoring devices in such a way as to ensure continuous operations".

DISCOVER MORE



## THE ONLY HANDHELD ANALYZER THAT MEASURES CARBON WITH PRECISION

As the only laser-based (LIBS) handheld with the precision needed for NDT/PMI across all alloy bases, the Z sets a new standard in speed and accuracy. Its powerful high-frequency laser and onboard argon purge enable unmatched performance, excelling in aluminum alloys by detecting key elements like Mg, Si, Li, Be, and B.

SciAps





# INSPECTION STARTS WITH US.



As world leaders in nondestructive testing, we offer the broadest portfolio of industrial inspection solutions, from industrial radiography and computed tomography to remote visual inspection, ultrasound, and robotic inspection.

With more than 125 years of NDT experience, we provide safety, quality and reliability for customers around the world.

waygate-tech.com





## PBU 350

Portable Magnetic Particple Inspection Bench

LEARN MORE »



## Lizard M8 for Top Side & Subsea Inspection

Advanced Electromagnetic Defect Detection & Corrosion Mapping system for structural & Material Integrity Assessments.

Learn More



Guarding Infrastructure, Powering Innovation,  
& Securing Tomorrow.

# ASSET INTEGRITY AUTOMATION AND CYBERSECURITY

## Conference and Showcase

- Oil and Gas
- Maritime
- Heavy Industries
- Utilities

9-10  
JUNE 2026

LAGOS,  
NIGERIA



KEYNOTE SPEAKER

**Engr. Audu Ibrahim**

Managing Director  
NNPC Gas Infrastructure Company Limited

To Register >>

+971 48374300

register@aiacafrika.com

www.aiacafrika.com





**NDT**  
Trends.



# Global NDT Community

Connecting Dots, Elevating NDT

---

[www.onestopndt.com](http://www.onestopndt.com)